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Scope of organic vegetable production and marketing in Haryana: A review

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Abstract
In Haryana, vegetable area and production were 4, 65,000 ha and 79, 05,000 Mt during 2017-18, respectively. According to national nutrition guidelines recommendation for intake of vegetables is at least 300 grams per person per day but we are consuming much less. Organic vegetables farming is not only financially less draining for the small farmer rather good for environment so that the scope of success is much more in organic vegetables production because most of the vegetables have higher cropping intensity, easily weed control through natural mulching, fit very well in the different multiple and inter-cropping system and capable of giving very high yield. Haryana have an opportunity to take advantage of its proximity to the national capital. No doubt organic vegetable farming is productive and sustainable, but there is a need for strong support to it in the form of infrastructure, subsidies, agricultural extension services, research and marketing.

Keywords: Marketing, organic, vegetables, production

Introduction
Haryana has a very fertile land and is called the 'Green land of India'. Nearly 80% of the total area is under cultivation of which about 84% irrigated with 182% cropping intensity [1] and vegetable area and production were 4,65,000 ha and 79,05,000 Mt during 2017-18, respectively [2]. Organic Farming is giving back to the nature what is taken from it. It is not mere non-chemicalism in agriculture; it is a system of farming based on integral relationship [3]. This is a production system which avoids or largely excludes the use of synthetically compounded fertilizers, growth regulators and livestock feed additives [4]. The intensification of agriculture, excess and indiscriminate or imbalance uses of inorganic fertilizer and agrochemicals have deteriorated soil health badly with deficiency of macro and micronutrient. The indiscriminate use of chemical inputs in agriculture fears/concerns the contamination of foods with agro-chemicals and may lead to various kinds of health hazards. Hence there is need to produce food free of contaminants [5]. It has been estimated that in India every year 280 million tonnes cattle dung, 273 million tonnes crop residues, 285 million tonnes compost and 6351 million cubic meter domestic wastes are produced which can be reused and recycled effectively in order to promote organic farming in India. Organic farming of vegetables is still in its infancy in India and there is not much work done in this field [6].

Components of organic vegetable production
1. Green Manuring
A practice of ancient origin is defined as the use of undecomposed green plant material, grown in situ or cut and brought in for incorporation to improve soil productivity [7]. Green manures added to the soil had its significant impact in improving soil conditions although some certain amounts of nutrients, particularly nitrogen could have been taken up by the okra plants during the growth period [8]. The decomposition of green manures added to the soil improves soil conditions by increasing organic matter, soil organic carbon concentration, humus and polysaccharides have been reported [9-12]. Furthermore, the improvement of soil conditions includes soil aggregation, pore spaces, bulk density and ability to absorb a considerable amount of water [13]. Nevertheless, it has been reported that in most areas in the tropics soil deterioration could be most rapid due to a rapid decomposition rate as a result of high soil temperatures [14-18]. Thus growers of the crop plants, particularly vegetable crops need to add more plant materials to their soils annually. When leguminous crops are grown and used for green manures they provide up to 40% of nitrogen available in soils by the decomposition of nodules and other biomass of the leguminous green manure crops [19].

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2. Organic Manures

The materials which are organic in origin, bulky in nature and capable of supplying plant materials in available forms having no definite chemical composition with very low analytical value and generally produced from animal and plant waste products are called manures [21]. According to IFOAM principle of ecology 'inputs should be reduced by recycling and efficient management of materials and energy [22].

3. Compost for Vegetables

Compost is reported to replace 50% inorganic fertilizer in tomato [23]. Application of compost prepared from sea weed enhanced growth, moisture, lipid and protein content of vegetables [24].

4. Vermicompost

Vermicompost and perlite: cocopeat (2:1:1) in characters chlorophyll a and b has the highest average. Finally the vermicompost: perlite: cocopeat (1:1:2) was highest average of carotenoids [25]. In capsicum, annum crop maximum leaf chlorophyll content 2.9% was estimated from the vermicomposting plot of 20%. Effective results were obtained after application of organic fertilizer as compared to the chemical fertilizer [26]. The number of marketable fruits per plant was significantly 1.5 and 1.9 times greater in the 1:2 and 1:3 vermicompost: soil treatments compared to plants cultivated in unamended soil after 90 days. The addition of vermicompost to soil increased soluble solids in pepper fruits >20B compared to fruits from plants cultivated in unamended soil while their pH was significantly lower [27]. Almost all the growth, yield and quality parameters increased significantly as compared to control, though the increase within the treatments was not found to be significant in tomato [28]. Vermicompost and manure produced significant increases in plant growth and marketable yield and also affected the chemical composition and quality of the marketable sweet corn [29]. In addition of vermicompost with rate of 15 t ha-1 significantly (at $p<0.05$) increased growth and yield of tomato compared to control [30]. The treatment plots (T6) showed 73% better yield of fruits than control, Besides vermicompost supplemented with N:P:K treated plots (T5) displayed better results with regard to fresh weight of leaves, dry weight of leaves, dry weight of fruits, number of branches and number of fruits per plant from other fertilizers treated tomato plants [31]. The requirement of vermicompost for leafy crops like spinach was lower (4 t/ha), whereas that for tuber crops like potato and turnip was higher (6 t/ha) [32]. Factors contributed to the in increasing of muskmelon seedling growth may be result of an improvement of physical and chemical properties of the substrate when combination between vermicompost, rice hull ash and coconut husk [33].

A number of studies conducted by many workers have demonstrated the viability of composting technology for utilization of fruit and vegetable wastes for production of vermicompost. Increase in Nitrogen, Phosphorous and Potassium content of the vermicompost prepared from wastes of green peas, brinjal, french beans, cabbages, tomatoes, parts of cauliflower and carrot collected from markets by Eisenia foetida [34]. Vegetable waste amended with cattle manure produced high quality stable compost free from pathogens. The findings can be promoted as a sound vegetable wastes recycling technology to conserve natural resources for organic production of vegetables [35]. Application of five group of crop residues like bhang (Cannabis sativus) leaves, parthenium weeds, gulmohar and peepal leaves to the soil @ 15t/ha each before raising cowpea crop in a cowpea-potato-cucumber rotation and subsequently the crop residues of cowpea, potato (haulms) and cucumber were added in succession after harvest of each crop and before sowing of succeeding crop resulted a positive effect on the yield of crops and enriched the soil with organic matter [36].

5. Biofertilizer

Application of bio-fertilizer is of great significance in organic vegetable production. As they play a nutritional stimulatory and the therapeutic role in improving growth, yield and quality of vegetable crops. Bio fertilizers has been broadly classified as nitrogen bio fertilizers, phosphate bio fertilizers and plant growth promoting bio fertilizers which also includes potassium solubilizing microorganisms.

Rhizobium

The concept of microbial inoculation started with legume Rhizobium inoculant first patented by Nobe and Hiltner in 1896 [38]. The yield of plant material and nutrient uptake by the Hedysarum coronarium was stimulated beyond that achieved by adding a standard dose of a compound N-P-K fertilizer with the help of rhizobium an encouraging response in terms of increasing yield of pea and cowpea [39, 40, 42].

Azotobacter

Inoculation with efficient strain of Azotobacter is known to improve the yield (9.60 to 24.30%) and nitrogen economy (25%) of cabbage, garlic and knol-khol at 2-40% [43, 45].

Azospirillum

They are called as associative endosymbiont on roots of grasses and similar types of plants. They are also known to fix atmospheric nitrogen and benefit host plants by supplying growth hormones and vitamins. Generally the nitrogen requirement of non-leguminous crops such as horticultural crops met partly from the activities of associative symbiotic bacteria-Azospirillum as well as increased the yield and nitrogen economy of vegetables [46, 49].

Phosphous solublizing bacteria (PSB)

Number of scientific findings were well documented that application of Azospirillum and other plant growth promoting rhizobacteria improve the plant growth and yield of commercially important crops like tomato, brinjal and chillies [50]. Tomato growth, yield and quality parameters such as TSS, ascorbic acid and lycopene contents were higher in plants grown with phosphobacteria and Azospirillum [51]. The Chilli cultivars (Arka Lohit, Arka Jwala and Arka Anamika) and Brinjal inoculated with Phosphobacteria found to increase crop growth and yield [52]. Tomato plants were inoculated with culture isolate Bacillus PSB-24 and various morphological growth characters were analyzed at different time intervals. The culture inoculum of Bacillus PSB-24 caused an increase in growth parameters over control and showed better growth in shoot as well as root and an enhancement in both root and shoot dry and fresh weight in tomato plants [53]. Increased in the yield of various crops were demonstrated due to inoculation of peat based cultures of phosphobacteria and saving up to 50% of recommended level of P2O5 was observed in many experiments [54, 57].

Potasium solublizing bacteria (KSB)

Inoculation of seeds and seedlings of different plants with KSB generally showed significant enhancement of germination percentage, seedling vigour, plant growth and yield and K uptake by plants under greenhouse and field conditions [58, 65]. Inoculation with KSB also exerted beneficial effects on growth of eggplant, pepper, cucumber, okra, brinjal and potato [66, 71]. These studies indicate that the use of KSB as bio-fertilizers for agriculture improvement can reduce the use of agrochemicals and support eco-friendly crop production [72, 73].

Vesicular Arbuscular Mycorrhiza (VAM)

The mycorrhizal fungi mobilize phosphates and other micronutrients like zinc, boron and molybdenum from adjacent soil to the root system through hyphal network. The enhanced uptake of phosphorus and increased plant growth due to inoculation of soil with VAM fungi in vegetable crops such chilli, tomato, asparagus, potato, lettuce, and onion [74, 80].

Combined inoculation

The highest number of fruits, fruit weight, length of fruits and thickness of fruits were obtained with the application of combination of organic manures together with Azotobacter and PSB in okra crop [81]. Seeds inoculation of tomato plants with a mixture of Azotobacter chroococcum, Azospirillum brasilense and Bacillus subtilus results an increase in fresh and dry weight of plants over inoculating plants with Azospirillum brasilense or Azotobacter chroococcum alone [82]. The effect of vesicular arbuscular mycorrhizal fungi and its combination with Azotobacter chroococcum, Azospirillum lipoferum on Capsicum cv. California Wonder found that plant dry weight significantly increased by mycorrhizal inoculation together with different diazotrophs [83].

6. Weed Management

The conservation agriculture is an agricultural management practice which includes minimum soil disturbance, retention of residue for soil cover and rotation of crops in its simplest form. Paddy straw mulch at 6 t/ha in potato and 9-10 t/ha in turmeric recorded effective control of mixed weed flora [84, 85]. Mulching generally prevents the germination of light sensitive weeds like Ageratum conyzoides, Portulaca oleraceae etc. [86]. Minimum soil disturbance which is one of the 3CA principles includes a range of tillage regimes affects the vertical weed seed distribution. It was reported that seeds infiltrate in soil very slowly in no tilled soil as compared to conventional tillage which in turn results in concentration of weed seeds that constitutes about 60-90% in the top 5cm of soil surface [87].

7. Pest Management

The compost tea is used on suppression of certain insect-pests of vegetable crops [88]. Some rhizobial isolates have properties of bio control agents and may be applied to promote the growth and suppression of Fusarium wilt of fenugreek [89]. Some of the serious insect-pests viz., brinjal shoots and fruit borer (*Leucinodes orbonalis*), Carrot rust fly (Pistia rosae), Colorado potato beetle (*Leptinotarsa decemlineata*) and onion maggot (Delia antique) were managed by following crop rotation techniques [90, 93].

Vegetable productivity under organic farming

The study conducted on organic farming in vegetable crops at IIVR, Varanasi, revealed that the productivity of vegetables crop in organic farming was less in initial years but the yields increased progressively under organic farming equating the yields under conventional inorganic farming in 4-5 year [94-95]. After practicing 5-6 years of organic farming with the soil fertility sufficiently restored the yield realized in organic farming of vegetable is either comparable or more than that realized in conventional farming. In irrigated areas, organic agriculture has shown the potential to increase the yield [96, 97]. A long-term experiment as conducted by ICRISAT also sustains the view that yield of different crops in low cost sustainable system, the annual productivity (rainy + post-rainy season yields), in particular is comparable to that in the conventional system [98]. Productivity of organic farming may be less in initial years, but the yields increased progressively under organic farming equating the yields under inorganic farming by sixth year [99].

Table 1: Yields of organic farming vs conventional farming

Year	Status	Yield (q/ha)
Conventional	-	10
First year	Year of conversion	5
Second year	Year of conversion	5.75
Third year	Organic	6.25
Forth year	Organic	7.5
Fifth year	Organic	8.75
Sixth year	Organic	10

(***Source***: Rajendran *et al*. 1999)

Okra responded to poultry manure @ 20kg N/ha [100]. There was increase in protein and mineral content of okra crop by application of FYM as compared to commercial manures [101]. Higher yield was also recorded by application of neem cake [102]. Application of bio-fertilizers with chemical fertilizers increases the availability of NPK in soil and fruit in okra [103]. The highest returns obtained from cauliflower production by mulching with mango leaves [104].

Marketing of Vegetables in Haryana State

Haryana can take advantage of being the proximity to the National Capital of India. It have highest NCR area (25,327) with thirteen districts as compare to Uttar Pradesh (14,727) and Rajasthan (13,447) as well as it have dense and better road networks with productive land as compare to neighbours states [105]. Haryana is a richest state and Delhi has highest GDP per capita ($12,747) in India [106].

The research has shown that the conventional farming system is economically more profitable than organic farming in the horticultural sector of the Niayes region in Senegal [107]. The policies implemented by the government of India to encourage organic farming regarding the commencement, implementation and the marketing of organic food products as well as the increasing demand of the organic products in the domestic as well as international market, there is ample scope for organic food industries to expand and generate revenue for strengthening the Indian economy [108].

The steps needed for promoting organic farming include cost support or premium, certification or conversion support or subsidy as done in California (upto 70 per cent) by the USDA in 2001 and in the EU for conversion to or continuing with organic production under the EU-Agri environment programme since 1993 [109]. Promotion of market mechanisms like Mumbai Grahak Panchayat which had dedicated consumer groups who place advance orders. But, it is market oriented programmes which are more sustainable as was the case in Denmark [110]. The high price expectations, delayed delivery, quality restrictions, lack of certification and marketing networks are some of the constraints in marketing organic products internationally [111].

The complicated production technology alienation of farmers from the concept, lack of standards and lack of large market opportunities comparable to those for non-organic produce markets [112]. The lower organic production cost coupled with adequate price premiums makes organic production competitive and profitable.

Constrains of Organic Vegetable Production and Marketing of Haryana

Organic farming practices are new to the farmers of Haryana and hence, the knowledge levels are low in most of the practices [113].

Farmers who are not risk averse are more likely to adopt organic farming [114].

Farmers' apprehension towards organic farming in India is rooted in non-availability of sufficient organic supplements, bio fertilizers and local market for organic produce and poor access to guidelines, certification and input costs [115].

Haryana has used external input intensively, now switching from external input intensive forms of agriculture, the yield may decline significantly, at least in the initial years of conversion until the natural soil tilth and fertility are sufficiently developed.

It is clear that one of the major difficulties of the new push for organic agriculture in Haryana is small farm size.

In the recent years, specifically with the shift in political regime in 2005, the land prices, both government and market prices, in Haryana have gotten fire, more than tripled in last years.

There is an absence of price incentives for organic farm produces [116].

Conclusion

Haryana have an opportunity to take advantage of its proximity to the national capital and his two metro-cities (Gurgaon-Faridabad) as organic market. It has highest NCR area with productive land, high density and good condition road network as compare to Uttar Pradesh and Rajasthan. India and World Wide Research show that Organic Vegetables can be easily grown but there is a need for strong support to it in the form of infrastructure, subsidies, agricultural extension services, research and marketing like conventional vegetable production.

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